

Testimony of
Daniel Cheifetz
Chief Executive Officer
Indie Energy Systems Company, LLC
Evanston, Illinois
before the
Subcommittee on Energy and Environment
Committee on Science and Technology
U.S. House of Representatives
“Options and Opportunities for Onsite Renewable Energy Integration”
November 15, 2010

Good morning Chairman Carnahan, Ranking Member Biggert and Members of the Subcommittee, staff, and guests.

My name is Daniel Cheifetz. I am the CEO of Indie Energy Systems Company. Indie Energy is a leading developer of smart geothermal technology systems for heating and cooling buildings by integrating them with their on-site renewable geothermal energy resource in a way that decreases the cost of adoption while radically increasing energy efficiencies. We are a private company headquartered in Evanston, Illinois. Forty percent (40%) of our employees are in R&D and engineering, while 40% are in our high-tech energy field construction division.

I appreciate the opportunity to testify before you today on a subject that is important, hopeful, and exciting.

I have been asked to address four areas:

1. Examples of geothermal integration projects, including the demonstration project that was a recipient of a U.S. Department of Energy competitive funding award
2. The Smart Geothermal technology Indie Energy has developed to enable widespread adoption of geothermal-based heating and cooling systems for the built environment
3. The state of the market and the need for innovation
4. R&D recommendations for the Committee to consider related to the adoption of integrated geothermal systems in individual buildings as well as campus and district systems

Selected current projects

Walgreens’ first Smart Geothermal store, *Oak Park, IL*



Astellas Pharma US HQ, *Glenview, IL*



Medline Industries HQ Campus, *Mundelein, IL*



Selected current projects

Campus Retrofit of Local 150 of IUOE, *Countryside, IL*



Garrett Seminary dorm retrofit at Northwestern University, *Evanston, IL*



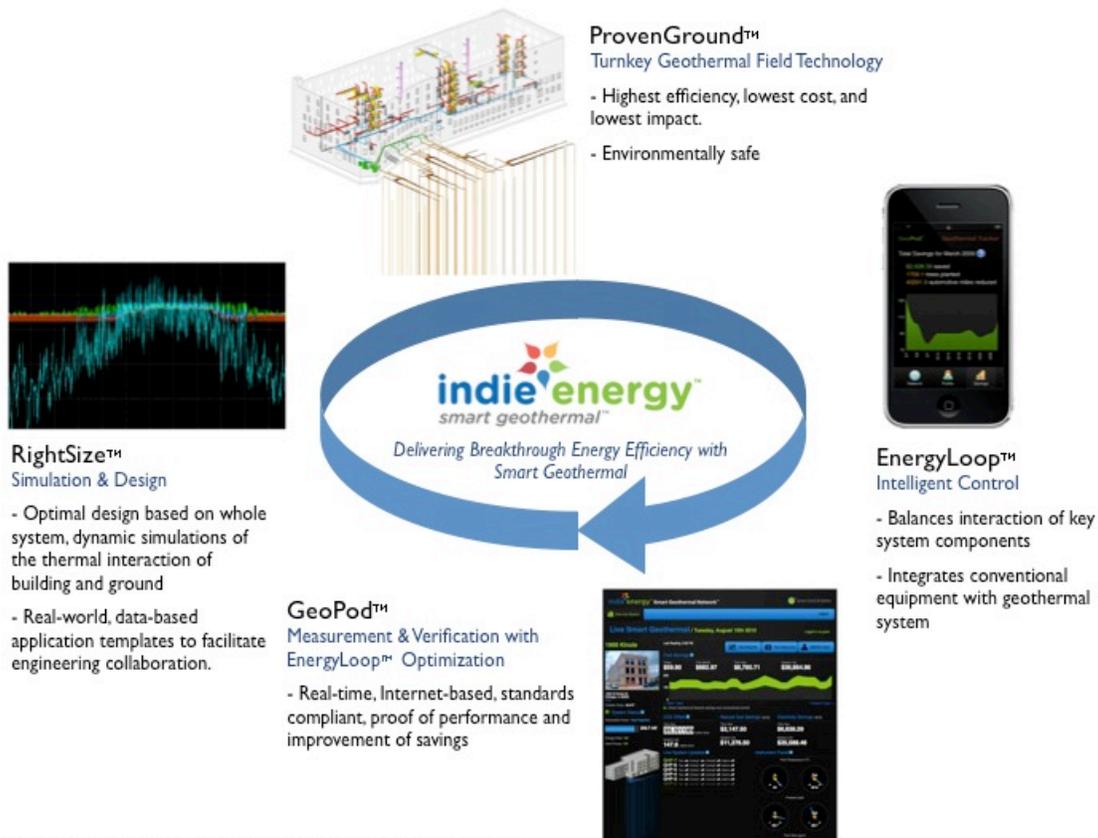
Casa Maravilla affordable housing development, *Chicago, IL*



Smart Geothermal™ Technologies

The following breakthrough technologies have driven Indie Energy's market leadership in the Chicago metropolitan area:

- 1) RightSize™ energy field and hybrid mechanical system designs that deliver the lowest build cost with the highest energy efficiency.
- 2) ProvenGround™ turnkey energy fields utilize the Company's exclusive drilling technology, which provides a dramatically higher standard for quality, speed, and cost of construction.
- 3) GeoPod™ measurement and verification systems monitor the Smart Geothermal system remotely, in real-time, and provide cost and carbon savings information, dashboard displays for owners and public, and maintenance alerts.
- 4) EnergyLoop™ controls and adaptive optimization systems provide ongoing improvements in cost savings and energy efficiency by controlling the dynamic interactions between the building, ground and grid.



The Potential of Onsite Geothermal and the Need for Innovation

For decades, we have known a lot about geothermal for heating and cooling buildings.

We have known that geothermal energy exchange is an effective, renewable way to significantly reduce heating and cooling costs and greenhouse gas emissions.

We have known that anything that can be done with an HVAC/R (heating, ventilation, air conditioning, refrigeration) system can be done with a geothermal system – a mechanical system that couples the building with the ground.

We have known that geothermal-based heating and cooling has been successfully used in every climate, and in every building type. In fact, a DOE report at the end of 2008 stated that these systems “...use the only renewable energy resource that is available at every building’s point of use, on-demand, that cannot be depleted (assuming proper design), and is potentially affordable in all 50 states.”

However, what we know is not always consistent with what we do. Less than one-tenth of one percent of buildings make use of their onsite earth resource for heating and cooling. It is as if our rooms are still illuminated by kerosene lamps because we have not been able to deploy a technology for electric lighting.

This is due to technical, financial, and educational gaps. Innovation is the key to bridging those gaps, and Indie Energy’s mission is to develop and deliver the technology innovations needed to enable a widespread transformation of our built environment to one much more healthy economically and environmentally through the use of smart geothermal technology systems.

Beyond First Generation Geothermal

Compared to conventional, first generation geothermal, Indie Energy Smart Geothermal™ technology provides substantial economic benefits on two fronts: lower build cost, and radically higher operating efficiencies. Indie Energy has developed high-resolution state-of-the-art technology for understanding the dynamic thermal exchange between the building, its use, and the earth (the geothermal energy field). This has allowed Indie Energy to develop and prove a range of innovative products and solutions for simulation, measurement, verification, control and optimization which are currently powering Indie Energy’s turnkey systems and which can also be embedded by channel partners in third-party-built systems.

These innovative technologies enable extremely energy efficient geothermal heating and cooling systems whose performance can be proven. Even more importantly, these technologies overcome the most significant barrier to adoption² – the high first cost of the system with inadequate return on investment.

Indie Energy has proven its enabling, embeddable technologies for integrating onsite renewable geothermal energy in millions of square feet of commercial, public, and institutional geothermal building systems, both new and existing, in the Chicago metropolitan area.

A number of R&D initiatives have been undertaken:

Indie Energy has been awarded a \$2.45 million matching competitive grant by DOE to demonstrate what the DOE called its “transformative technologies” at a retrofit of a 166,000 square foot, three-building campus. Some of the technologies demonstrated are a district system (in which one geothermal energy field is shared by three buildings), Indie Energy’s GeoPod™ for real-time measurement and verification utilizing a moving baseline, and Indie Energy’s Smart Geothermal Network™ and EnergyLoop™ Controls.

In order to help develop standards for smart geothermal system technology, Indie Energy has engaged the Oak Ridge National Laboratory to evaluate its GeoPod™ technology.

In order to assist in the development of shared research databases, Indie Energy is working with the National Renewable Energy Laboratory to make Indie Energy’s Smart Geothermal Network™ available to researchers and projects nationwide.

In order to push the envelope in materials science to develop breakthroughs in thermal transfer and storage media, Indie Energy has entered into an R&D relationship with the University of Illinois at Chicago.

In order to advance the state of the art in geothermal energy field construction, Indie Energy has entered into a multi-year joint R&D agreement with GeaWelltech, the Swedish manufacturer of the specialized geothermal drilling equipment used by Indie Energy.

Is There a Market?

There is no well-defined onsite geothermal heating and cooling industry in 2010. Rather, it is a fragmented landscape populated by engineering and architecture firms, drillers, HVAC installers, and equipment manufacturers with occasional ESCO and utility companies making appearances.

There are many data points and trend lines that point to the possible emergence of an industry that could drive large scale growth of an onsite geothermal industry for renewable heating and cooling:

In 2005 the geothermal heat pump market was a \$2.5 billion industry¹ in the United States. Since then, there has been significant growth driven in large part by rising energy costs, policy changes for greenhouse gas curtailment, and federal tax incentives passed in the American Recovery and Reinvestment Act. Manufacturers of geothermal heat pumps

¹ Galst, Liz, NY Times, *With Energy in Focus, Heat Pumps Win Fans*, August 13, 2008
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shipped 36,439 units in the U.S. in 2003, and 63,683 units in 2006. Data posted in 2005 show more than 600,000 geothermal heat pumps in operation in the U.S. alone.

A market report published by the U.S. Department of Energy in 2008 suggests that geothermal technology for heating and cooling buildings could become a major contributor to the national energy policy movement, with the potential to save \$38 billion annually in energy costs². The report identifies key technologies required for this to take place. (These are the technologies that Indie Energy has developed and proven.)

The City of Chicago Climate Action Plan has recently (September 2010) published recommendations of the Environmental Law and Policy Center’s Clean and Renewable Energy Working Group³ that the City undertake geothermal projects for one hundred million square feet of existing buildings over the next ten years to reduce 0.271 million metric tons of greenhouse gases. While Indie Energy discounts these figures in its own projections of near-term market size, they suggest that the potential market in the top ten metropolitan areas in the U.S. is approximately \$4 billion for its Smart Geothermal™ technology alone.

A Way Forward through Applied R&D

I come out of the software industry. We bet our futures on exponentially accelerating price performance ratios. We saw the power of DARPA and the resultant Internet. It’s the technology wave my company rode, and if you have ridden a wave like that, you get to feel its characteristics in your bones. Renewable energy and clean technology is such a wave.

As Ray Kurzweil has pointed out in his *Law of Accelerating Returns*, “...technology, particularly the pace of technological change, advances (at least) exponentially, not linearly, and has been doing so since the advent of technology, indeed since the advent of evolution on Earth.” And that rate of exponential growth itself grows exponentially.

About half of the growth in the U.S. GDP since World War II is related to the development and adoption of new technologies. That fact has not been lost on the rest of the world. So, it’s not a question of whether there will be technological change in onsite renewable energy technology, or even when it will start. It has started in earnest in many places around the world that are starting to ride up the exponential innovation curve. The only question is whether we in the U.S. will participate before the curve gets too steep for us to earn our place as technology pioneers once again.

In addition to longer term, very high dollar “pure” research, we can achieve exponential improvements with a combination of additive steps as long as we think and design with a

2 Hughes, Patrick, Oak Ridge National Laboratory, *Geothermal (Ground-Source) Heat Pumps:Market Status, Barriers to Adoption, and Actions to Overcome Barriers*, December, 2008

3 <http://elpc.org/2010/10/19/report-of-the-clean-and-renewable-energy-working-group-released>

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whole systems approach, and as long as we are not driven so much by the competition of others as by the prospect of a competing, unhappy, alternate future.

To bring this about we need a significant portion of our nation’s R&D to be applied R&D, focused on delivering incremental breakthroughs in the short term. These are breakthroughs that could be market-ready (if not “shovel-ready”) and quickly move into the supply chain. They would attract capital to products and projects and have an almost immediate effect on job creation.

Here are some of the things that are opportunities for onsite renewable energy integration:

We would like to see low-grade-heat combined heat and power engines that we can plug into our systems to make them more energy efficient and the grid smarter.

We would like to see variable speed compressors; better heat exchangers; and low temperature (140F and below) heating systems standards so that systems can be incrementally more efficient and feasible for demanding applications.

We expect more – in fact we are planning on seeing more – in-building wireless sensor and actuator networks from companies such as EnOcean so that we can implement more affordable systems and healthier, more productive, ground-coupled buildings.

Even relatively simple things like infrared smarter “thermostats” that can measure more than just dry bulb temperature would help us and our engineering and architecture partners create more comfortable and efficient micro zones in buildings that we could then interactively balance with all the other energy flows in the building and between the building and ground.

All these things will further enrich our building/energy simulation technology, populate our Smart Geothermal Network with real-time data for measurement and verification while providing our EnergyLoop™ Engine with rich data for ongoing dynamic control and extreme energy optimization.

Additional investments need to be made in technology to lower the construction cost of geothermal energy fields while improving quality. No matter how much additional efficiency we can squeeze out of a system, and no matter how much we are able to reduce costs with hybrid designs and new materials, the physical construction of the geothermal energy field will remain the largest barrier to adoption since that is where the greatest incremental cost is incurred. It is indicative of the underdeveloped state of onsite geothermal that almost without exception the equipment (drill rigs and compressors) used to construct the geothermal energy field has not seen a significant technological breakthrough. The R&D required to produce semi-automated high-speed production drilling equipment would be quickly amortized over the billions of dollars of value that they would generate. There is no doubt that this equipment will be developed and manufactured somewhere. Why not here?

Wherefore Art We?

It is not clear at this point if onsite renewable energy for buildings has found its real home in Washington D.C.. ARPA-E is a terrific new entity, but it may be more oriented to the “pure and big” than the “small, distributed, and now”. Onsite geothermal has had an identity crisis vis-à-vis geothermal power, but it is not clear how well its relocation to the Office of Energy Efficiency and Renewable Energy's (EERE) Building Technologies Program is working. Wherever the program ends up, it should lose the “Geothermal Heat Pump Program” tag. As instrumental as some of the equipment manufacturers have been in getting incentives for “GHP systems”, developing a real science and industry to integrate buildings with onsite renewable geothermal energy will not get the support it needs if it continues to be thought of as a collection of “heat pumps”, “wells”, and “loops”.

Conclusion

It used to take twenty years for a new technology to really become ubiquitous. We don't have twenty years for this new technology to become the standard for how we build our new buildings and fix our existing ones. Fortunately, this is not the kind of disruptive innovation that requires a whole new delivery mechanism, or the unseating of historical incumbents. This new energy infrastructure plugs into almost all the engineering, architectural, and construction channels that exist. These are channels that are actually motivated by, and have a hunger for, breakthroughs that can be effectively and pragmatically designed and delivered to their clients with lower risk than the status quo. This is not a technology where we have to create the need in order to build demand. The need is recognized, and there is a huge pent-up demand.

Indie Energy has created a set of technologies that enable the widespread adoption of onsite geothermal renewable energy systems for buildings. It is an embeddable technology that can work with the offerings and practices of engineering and architectural firms. In fact, that kind of collaboration is how many of our projects came about in the Chicago area. While the technology can travel, geothermal energy fields must be built onsite, where the buildings are – they cannot be built somewhere else and then shipped here. As we grow this industry, it cannot be outsourced or off-shored. Local workers will build local geothermal properties in their own communities. It will take a number of decades for us to fix our existing building stock; by then, we will be building new buildings again, and the standard for their mechanical systems will be based on onsite renewable smart geothermal.

Thank you very much for the opportunity to be with you here today.

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Daniel Cheifetz, *CEO and Founder, Indie Energy Systems Company*

Mr. Cheifetz is an experienced technology entrepreneur, whose achievements include a leadership role in the successful IPO of Open Text (Nasdaq: OTEX) in 1996. With more than 30 years of executive leadership in technology companies, he brings an extensive track record to the growing clean energy industry.

Experience

Indie Energy Systems Company, CEO 2006-present
Open Text (OTEX), Exec. VP, Development, Board member
Odesta Systems Corporation, Founder and CEO

Education

Grinnell College, BA